**State of Georgia**

**Department of Transportation**

# Perennial Stream Culvert Diagrams (Section 39 Plans) Guidance



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Atlanta, Georgia 30308

GDOT Georgia Department of Transportation

# PERENNIAL STREAM CULVERT DIAGRAMS (SECTION 39 PLANS)

## General

Perennial Stream Crossing Detail sheets provide additional information related to new culvert construction, or culvert replacement, at perennial streams (as identified and delineated in the Ecology Special Studies Report and indicated on the plans). These sheets are not required for existing culvert extensions at perennial streams, or new/replacement culverts which are not located at a perennial stream.

Perennial Stream Crossing Detail sheets should be developed through coordination between the roadway/hydraulics engineers and ecologists. Once finalized, these sheets are provided to the project ecology team for their use in permit applications.

## Required Information

For each perennial stream culvert a series of plan sheets/diagram are required:

- **Plan view diagram of the existing and proposed conditions**
  - Information shown on a typical 13-series construction plan sheet including:
    - Legend, Scale, North arrow
    - Roadway items (alignments, edges of pavement, curb and gutter, sidewalk, shoulders, driveways, guardrail/barriers, etc.)
    - Drainage items (including ditches, storm drain pipes, and culverts with structure number, flow arrow, and size labels)
    - Post-Construction Stormwater BMPs
    - Property lines with labels
    - Existing right-of-way and easement lines with labels
    - Proposed right-of-way and easement lines with labels
    - Construction limits (cut/fill lines with designations)
    - All ESAs including, but not limited to, state buffers, wetland boundaries, historical boundaries, T&E habitats, archaeological resources, hazardous materials, environmental justice areas, and streams (with labels)
    - Orange Barrier Fence
    - Retaining walls
    - Noise Barriers
    - Bridges

- Additional information shown only on the 39-series plan view:
  - Existing contours
  - Stream horizontal alignment (including stationing and tick marks):
    - Stationing should increase in the downstream direction; stream station numbering should not overlap with culvert station numbering
    - Stream flow direction indicated by arrows
    - Alignment should match the surveyed stream
    - Alignment should ideally cover the extents of the surveyed stream or plan sheet coverage (whichever is smaller).
    - At a minimum, alignment should cover the stream length from approximately 100 ft upstream of the proposed culvert inlet to approximately 100 ft downstream of the proposed culvert outlet
  - Proposed culvert (and channel excavation, if applicable) horizontal alignment
    - If the proposed culvert closely matches the stream along the entire culvert length, a proposed culvert alignment is not required (the existing stream alignment alone can suffice). This scenario may occur when replacing a culvert in the same location but otherwise be rare.
    - Stationing should increase in the downstream direction; culvert station numbering should not overlap with stream station numbering
    - Alignment should follow the centerline of the proposed culvert
    - Alignment length should cover the extents of the proposed construction only
      - Alignment should always cover the length of the proposed culvert from inlet end to outlet end.
      - When channel excavation is proposed to tie the culvert to the stream, the horizontal alignment should be extended beyond the culvert and apron to include the limits of the channel excavation.
    - Culvert alignment should intersect the stream alignment at its beginning and end.
      - Station equality labels should be shown at both ends of the alignment
  - Callouts indicating the location and station of stream and culvert cross sections shown on later sheets.

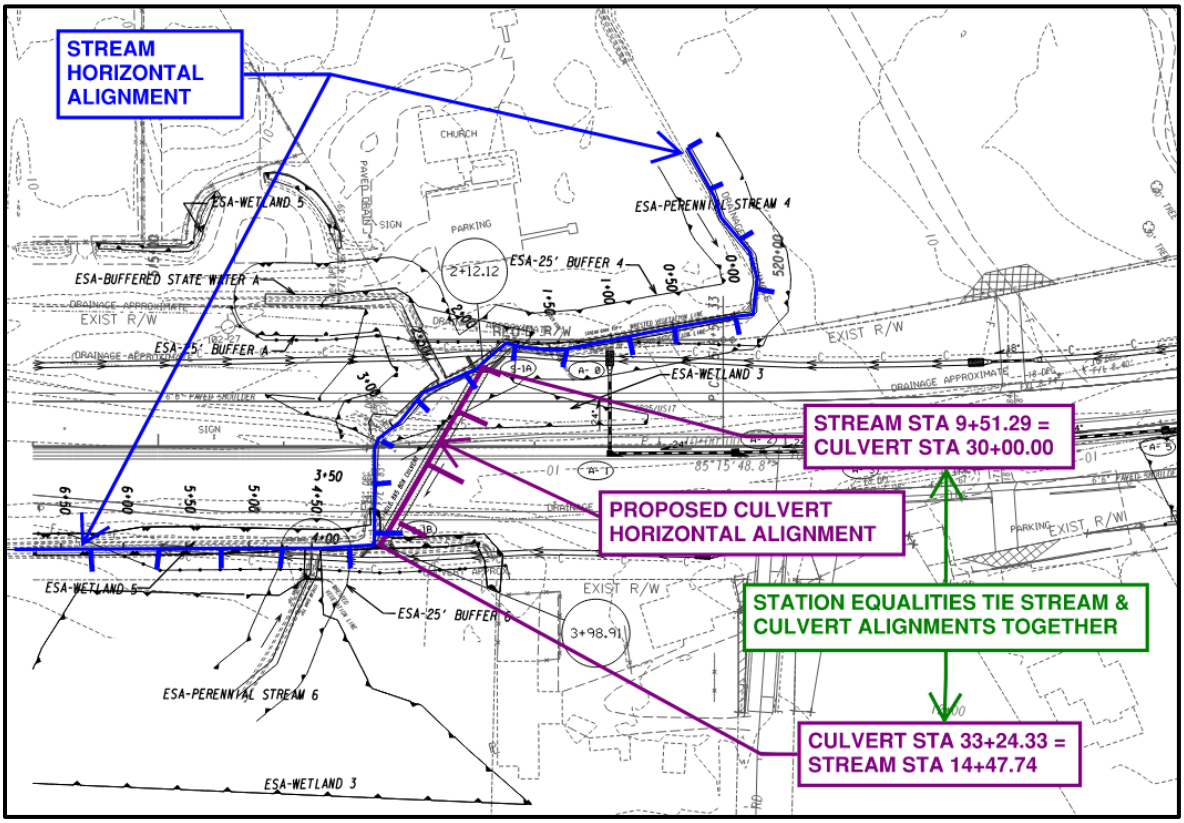


***Figure 1:*** *Example – schematic plan view diagram.*

- **Longitudinal profile diagram of the existing stream channel**
  - Even stations and existing ground elevations every 50 feet along stream alignment
  - Average streambed slope should be noted
  - Callouts indicating the location of the proposed culvert inlet and outlet
  - Callouts indicating the location and station of stream representative cross section(s) shown on later sheets.

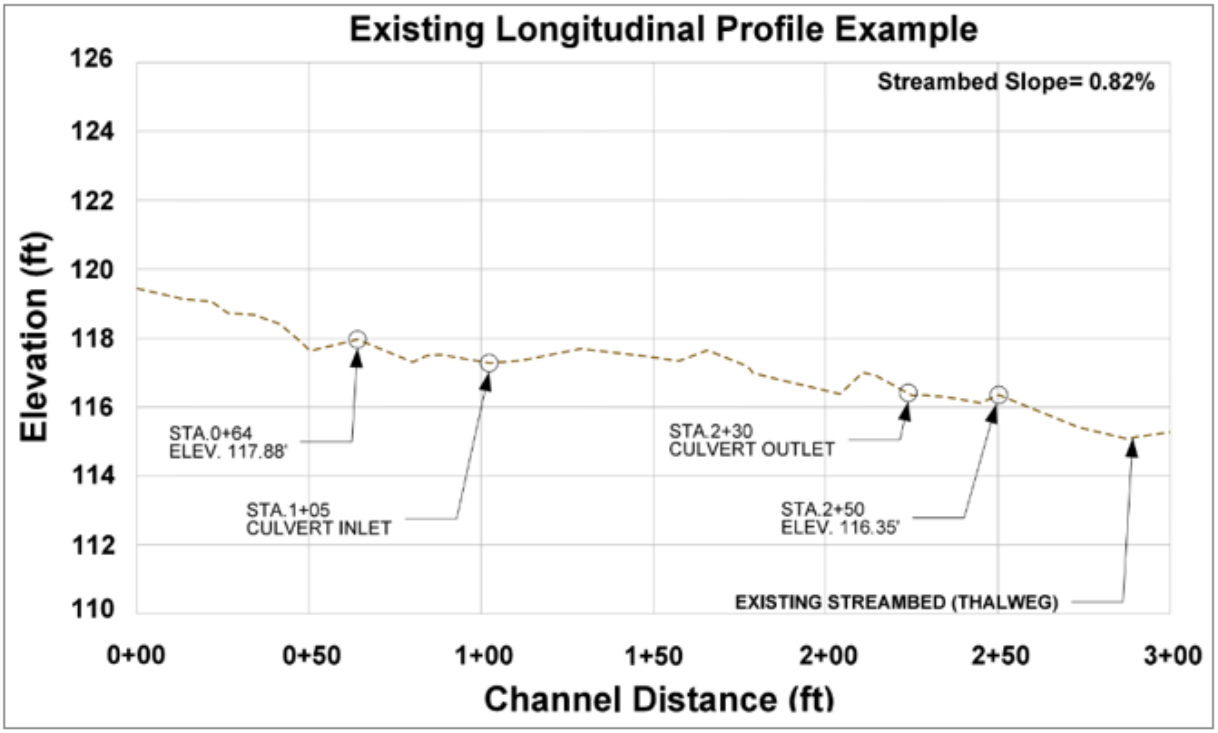


***Figure 2:*** *Example - longitudinal profile diagram of the existing stream channel from 2021 Regional Conditions.*

- **Longitudinal profile diagram of the proposed culvert**
  - The longitudinal profile shown on this sheet should be cut from the combined horizontal alignment representing the existing stream and proposed culvert
    - Beginning upstream this combined alignment will follow the existing stream channel until it intersects the proposed culvert (or channel excavation, if applicable), then follow the alignment of the proposed culvert until it (or channel excavation, if applicable) intersects the existing stream channel and continuing downstream
    - Where the stream and culvert alignments intersect, show station equality labels. These station equality labels should match the plan view station equality labels
  - Existing and proposed elevations
  - Proposed culvert:
    - Structure number
    - Invert elevations (accounting for any embedment depth)
    - Length, size, flow direction, longitudinal slope, embedment depth (feet)
    - Number of barrels
    - Anticipated substrate colonization line and callout within the culvert (terminating at each end of the culvert)
      - This line should “connect the dots” between the existing stream channel elevations at the culvert ends (or what would be the bottom of a non-embedded culvert)
      - Show as a dashed line with a different linestyle than existing ground

- Proposed energy dissipation/outlet protection:
  - Ensure rip rap for energy dissipation is properly reflected graphically (top of rip rap flush with top of ground)
- Proposed channel excavation (if required)
- Proposed road surface and areas of cut and fill
  - The proposed road surface should accurately reflect the proposed conditions along the combined stream/culvert alignment (do not simply apply a typical roadway template)
  - Do not show ditch bottoms or backslopes if not proposed at this location
- Callouts indicating the location and station of the proposed culvert inlet and outlet cross sections shown on later sheets.
- For clarity and simplicity, the following information typically shown on a drainage cross section sheet should not be shown on this diagram:
  - Georgia Standard or Detail information
  - Subgrade material under culverts (e.g. type II backfill graphics/callouts)
  - Design year headwater elevations
  - Design year outlet velocity
  - Culvert design height of fill
  - Concrete veins on culvert bottom

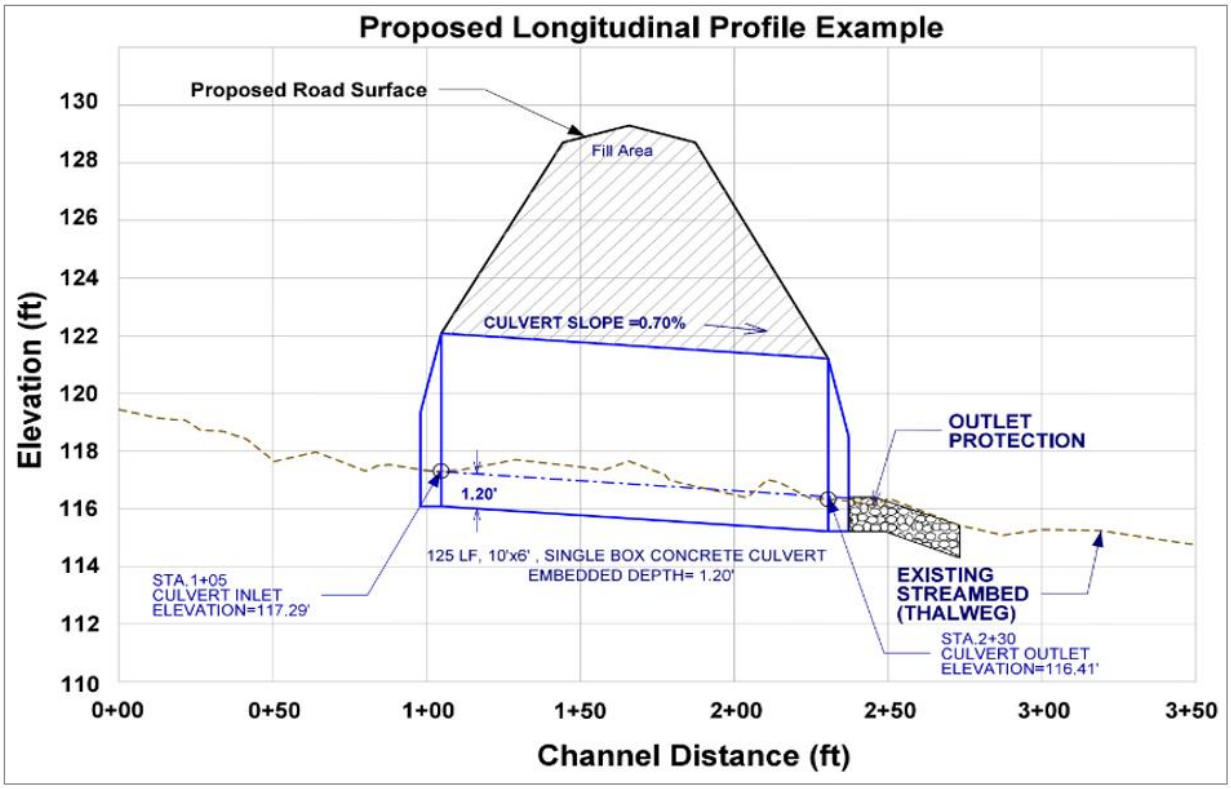


***Figure 3:*** *Example - longitudinal profile diagram of the proposed culvert from 2021 Regional Conditions.*

- **Representative cross-section diagram(s) of the existing stream channel**
  - Existing ground showing cross section view of stream channel bed and banks
  - Bankfull width and cross-sectional area:
    - The bankfull width shown on the representative cross-section is determined by the project team through a combination of methodologies which may include field indicators, hydraulic modeling, and regional curves.
    - Bankfull width should be shown graphically by a horizontal line within the stream channel
    - The corresponding width measurement should be shown (feet)
    - The bankfull cross-sectional area (square feet) value should be shown
      - Area bounded by the horizontal bankfull elevation line on the top, and bounded by the existing stream channel on the bottom and sides (see diagram below)
  - Flood prone "area":
    - Flood prone "area" should be shown graphically by a horizontal line within the stream channel, at a depth twice the bankfull depth (see diagram below)
      - Flood prone elevation = stream bottom elevation + (2 * bankfull depth)

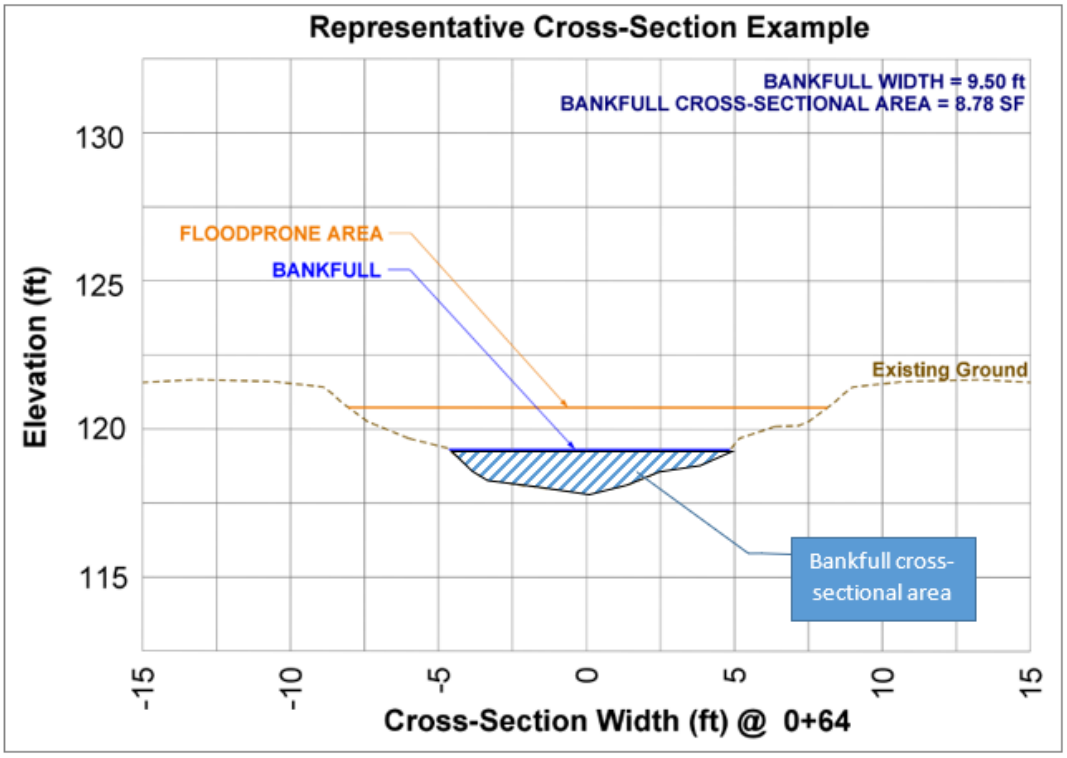


***Figure 4:*** *Example – representative cross-section diagram of the existing stream channel from 2021 Regional Conditions.*

- **Cross-sectional diagrams of the proposed culvert inlet and outlet**
  - Callouts for culvert size and type
  - Proposed road surface and areas of cut and fill
  - Proposed culvert invert elevation (embedded, if applicable)
  - Baffles with elevation labelled, if applicable
    - Note the term “baffle” refers to inlet baffles and not concrete veins on the culvert bottom
  - Existing stream channel with stream bottom elevation label
  - Bankfull width:
    - The bankfull width on the culvert inlet/outlet cross-sectional diagrams is determined by placing a horizontal line within the stream channel at the same depth as the maximum bankfull depth from the representative cross section.
    - The resulting bankfull width depicted on the inlet/out diagrams will likely be different from the bankfull width on the representative cross section due to channel geometry changing along the stream.
    - Note that even though a bankfull width is shown on the inlet/diagrams, it is the bankfull width at the representative section that drives the culvert width.
  - Flood prone “area” as noted above
  - Proposed bankfull cross-sectional area (square feet) value should be shown
    - Area bounded by the horizontal bankfull elevation line on the top, bounded by the existing stream bottom elevation on the bottom, and bounded by the proposed culvert on the sides (see diagram below)

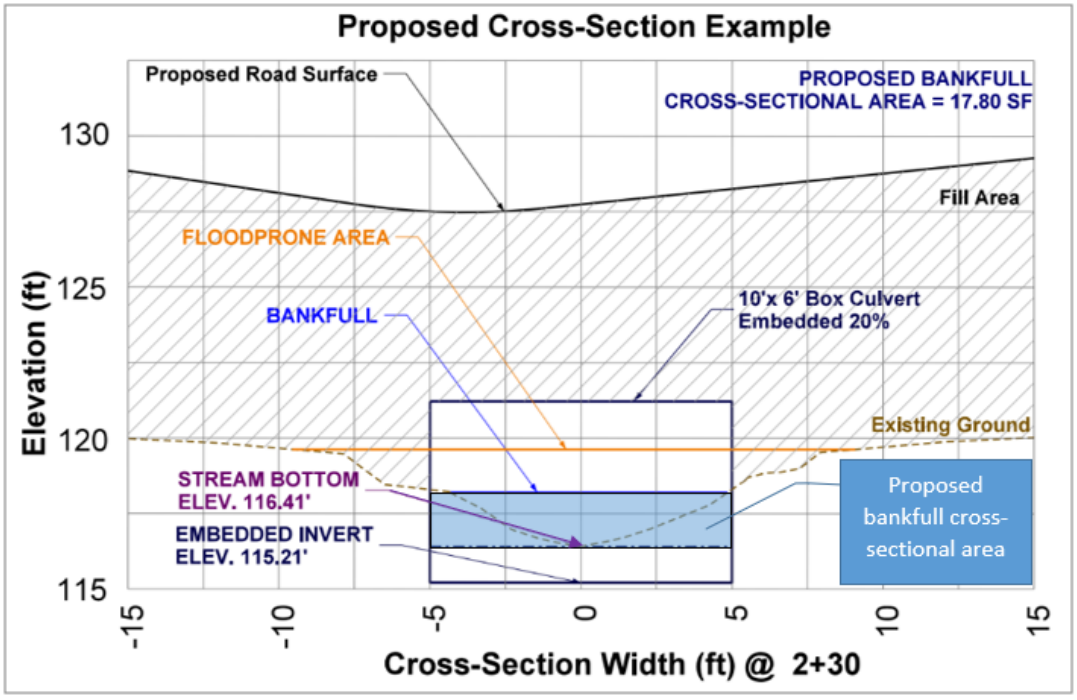


***Figure 5:*** *Example – cross-sectional diagram of the proposed culvert inlet/outlet from 2021 Regional Conditions.*

## Drawing Layout

For each new or replaced culvert at a perennial stream, a series of plan sheets (plan, profile, and cross sections) are required as described above.

**Sequence:**

Plan sheets should be grouped so that all relevant sheets for a specific culvert are numbered sequentially. Separate crossing locations should be organized with respect to the 13-series plan sheet conventions (begin project to end project). For example, if a project proposes two new or replaced culverts on perennial streams (PS-1 on sheet 13-05, and PS-2 on sheet 13-09), the 39-series plan sheet should be organized and presented accordingly:

- 39-0000: Table of contents listing each subsequent sheet number, name of perennial stream, type of culvert work, and type of diagram provided. For example:
- 39-0001: PS-1 (replacement) Plan View
- 39-0002: PS-1 (replacement) Longitudinal Profile View of existing stream channel
- 39-0003: PS-1 (replacement) Longitudinal Profile View of proposed culvert
- 39-0004 to 39-0005: PS-1 (replacement) Stream & culvert cross sections
- 39-0006: PS-2 (new location) Plan View
- 39-0007: PS-2 (new location) Longitudinal Profile View of existing stream channel
- 39-0008: PS-2 (new location) Longitudinal Profile View of proposed culvert
- 39-0009: PS-2 (new location) Stream & culvert cross sections

Please note that some of the view conventions above (profile vs. cross sections) differ from typical roadway plan conventions because the frame of reference is the perennial stream channel alignment instead of the roadway alignment.

**Size, Scale, and Plan Production:**

All 39-series plan sheets should be generated using 11” x 17” paper size.

All 39-series plan sheet should be generated using the highlighted GDOT plotting button in Figure 6 below. This plotting button will load the plot configuration and pen table files: “gdot-pdf-v8i-pr-o-po-ut-ss-11x17.pltcfg” and “gplotborder-V8i-PO-utilities-25.tbl”. PDFs created with these settings will allow the permit application reviewer to turn on/off each reference file or certain levels within reference files. Reminder – this plot driver should not be used for generating any other plan sets (e.g. PFPR, FFPR, final plans) including plan sections other than 39-series included in the Lockdown Plans submission.

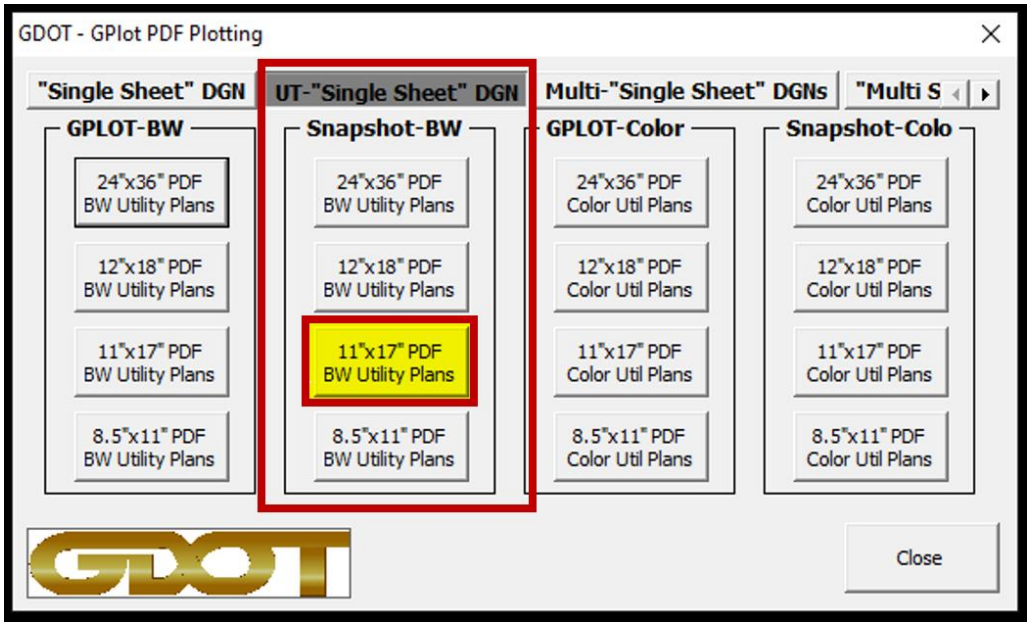


***Figure 6:*** *GDOT Plotting – use the highlighted plot drive to create PDFs with functionality of turning DGN levels off/on.*

The plan view sheets scale should match the 13-series plan sheets.

The longitudinal stream profile sheet scale should be the maximized to fit on a single plan sheet horizontally. Vertical exaggeration of 5x should typically be used to improve clarity.

The longitudinal culvert profile sheet scale should match the 22-series sheets (typically not vertically exaggerated).

The stream and culvert cross sections scale should be maximized to the extent possible. No more than two cross sections should be shown on each cross-section sheet. The horizontal and vertical scales should be the same (no vertical exaggeration should be applied).